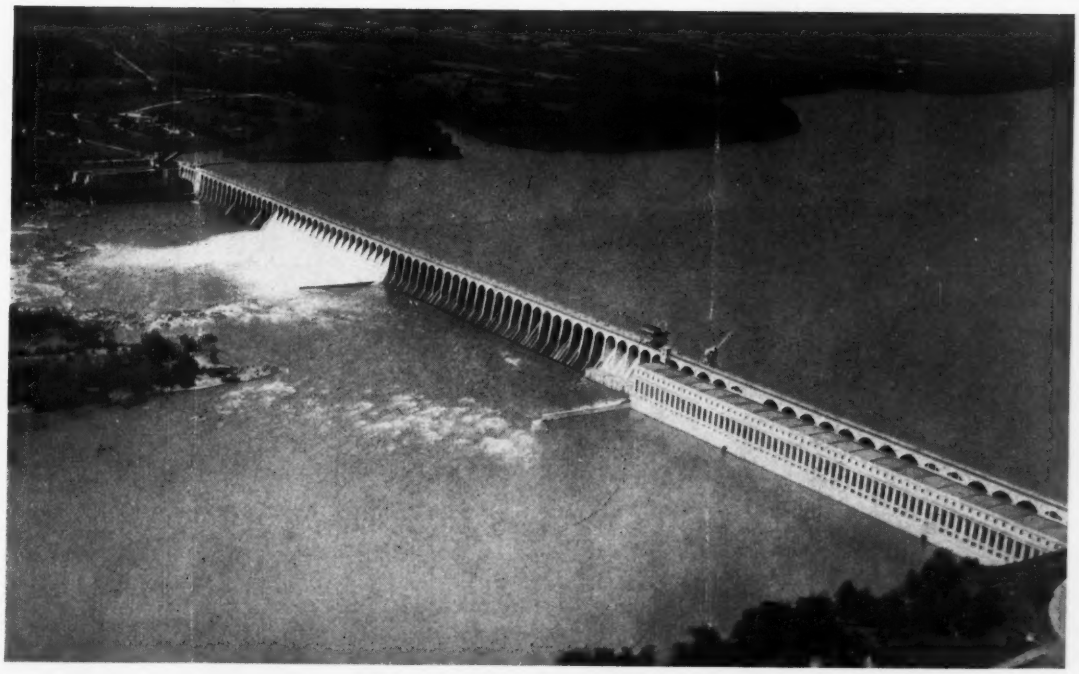
The CORNELL ENGINEER



In This Issue:

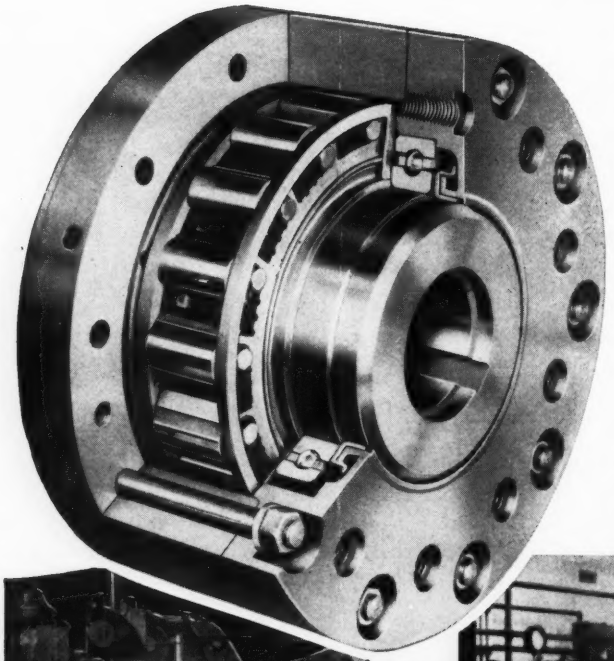
TRENDS IN ENGINEERING EDUCATION

By Dean Herman Diederichs

Volume 2 MARCH, 1937 Number 6

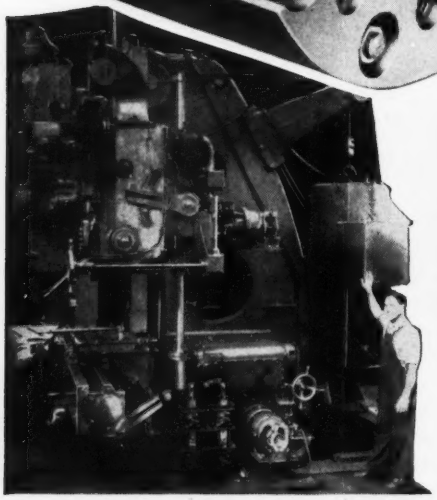
MORSE

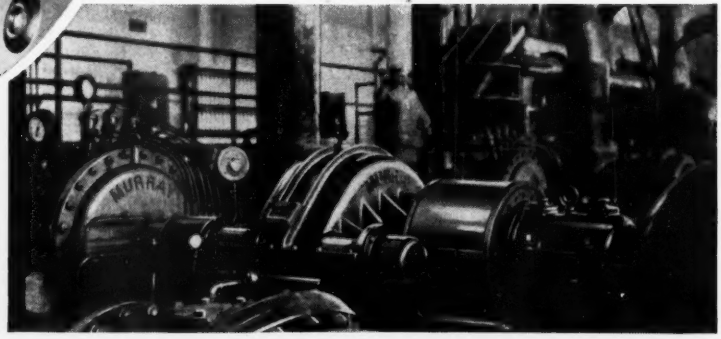
Kelpo FREE WHEELING CLUTCH



Wherever there's need for alternate or intermittent power between motors and machines, Kelpo Clutches fit right in. Morse Kelpo clutches are outstanding performers. Because a very light spring pressure holds the cams in position, free-wheeling resistance is cut to a minimum and each cam carries its full portion of the load. Because Kelpos contain more cams in any given diameter, they transmit power efficiently year after year—accurately and quietly.

For more information about Morse Kelpo clutches, call the Morse man in your territory or write to Morse, Ithaca.



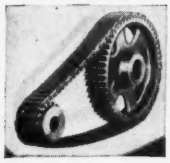


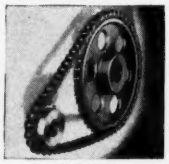
In production plants, paper mills, petroleum refineries, rubber goods plants and in scores of different industries—Morse Kelpo Clutches are helping motors run cool and at maximum efficiency.

If you have any motors running alternately or at intermittent speeds, you too, will find that Morse Kelpo clutches are a tremendous aid to better power transmission efficiency.

FOUR OTHER PRODUCTS *In the great* MORSE *family*

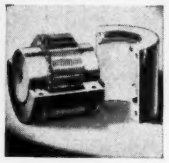
MORSE SILENT CHAINS

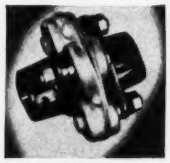




MORSE ROLLER CHAINS

MORSE CHAIN COUPLINGS





MORSE MORFLEX COUPLINGS

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Wearproof by Welding

Thus engineers obtain the service of the best alloys at the cost of ordinary steel

THROUGHOUT industry, wear on metals is an important cost factor. Until recently, most wearing parts had to be made entirely of special high-cost materials. Now, by welding, rapidly wearing surfaces can be covered with a wear-resistant alloy. Welded additions of bronze or Haynes Stellite—a wear-resisting alloy of cobalt, chromium and tungsten—create excellent wear resistance at low cost.

Long Life at Low Cost

Wherever metal has hard work to do, wearproofing by welding plays an important part. Under the toughest conditions, in mines and mills, in factories and on farms, in construction and oil-drilling, it is saving money and time.

Wearproofed parts will last many times as long as those made of unprotected iron or steel. Welding cost, including the necessary alloy, is only a fraction of the total cost of a new part. Then, after long, hard service, the part can be re-covered—another wear-resisting surface can be welded on at small cost, and the part is again as good as new.

Extensive Savings

Savings through the application of wear-resistant alloys are not confined to the lower cost of the part involved. Less power is used. Inventories are cut due to the consequently lowered investment and simplified control. Machine shutdowns for replacement are fewer. Maintenance costs are decreased, and a smaller crew can handle the necessary repairs. Further, the plant, without added equipment, can turn out a greater volume of production.

Figures drawn from case-histories where wearproofing is used are often surprising. A glance at the adjoining column will indicate many of the possibilities inherent in this process.

INTO THIS YAWNING CAVITY goes the dirt to make Grand Coulee Dam. Bucket front and teeth were hard-faced by welding. The result of this wearproofing was six months' service on Bonneville Dam, and many more months of trouble-free, repairless service on Grand Coulee.

Welding makes automotive exhaust valve seats good for 150,000 miles and more, with no regrinding in truck and bus motors, the toughest kind of service. These valve seats are wearproofed by welding Haynes Stellite to the contact surface. Ordinary cast-iron seats need regrinding every ten thousand miles.

* * *

Welding saved $2200 in one year for an Ohio pulp mill. Haynes Stellite was welded to the wearing surfaces of shredder knives. This work cost $90; knives, from the scrap heap, cost nothing. Hard-faced knives lasted for six months, and were again refaced by welding. New knives cost $200, last one month.

* * *

Welding a wear-resistant facing on the cutting edges of boiler-tube cleaners yields a twenty-fold saving—each cleaner will clean twenty times as many tubes as an ordinary cutter. When worn, hard-faced cutters are rebuilt for another long service.

* * *

Welding cured pump troubles in a pulp mill. Shafting on a sludge pump was wearing rapidly. Packing glands had to be tightened every hour, completely repacked once a week. The shaft was fast disappearing. Hard-faced by welding with wear-resistant metal, the shaft ran for three months with no attention, no appreciable wear.

* * *

Welding lengthens the life of blooming-mill shear clutches three times. Clutches previously ran 49 days, then went to the scrap pile. Now, wearproofed by welding, these clutches average 217 days before any attention is necessary. The same clutches are then refaced and used again.

* * *

Welding has solved an impossible lubricating problem. At a Southern mill where heater furnaces are fed by internal conveyor, rolls and bearings operate at 750 degrees Fahrenheit. Lubrication is impossible. A wear-resistant coating, built up on the rolls and bearings by welding, makes the conveyor last indefinitely, eliminates *need* for lubrication.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable and interesting technical booklets describing the application of the oxy-acetylene process are available without obligation. For further information write any Linde office.

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THE CORNELL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR

Volume 2 | MARCH, 1937 | Number 6

COMMENTS

In his "Trends in Engineering Education," Dean Diederichs presents an analysis of the educational requirements of the modern engineering curriculum. He discusses the attempts being made at the present time to obtain a balanced course in engineering training so that the engineer may have a full knowledge of not only technical practice but also economic and political organization and the so-called "finer things of life."

* * *

"The Railroads Prepare for Speed" and L. M. Genung shows just what is being done in this preparation—from road-bed changes and track layout revision to passenger train streamlining. The old order changeth.

* * *

As City Engineer and, incidentally, of course, a director and past president of the New York State Association of City Engineers, H. W. Eustance, C.E. '24, knows whereof he speaks when discussing municipal engineering affairs. For the alumni who do not return to Ithaca we present the article, *City Engineering in Ithaca*. This should tell these men of the physical changes in Ithaca and appeal to the more modern in a semi-technical vein.

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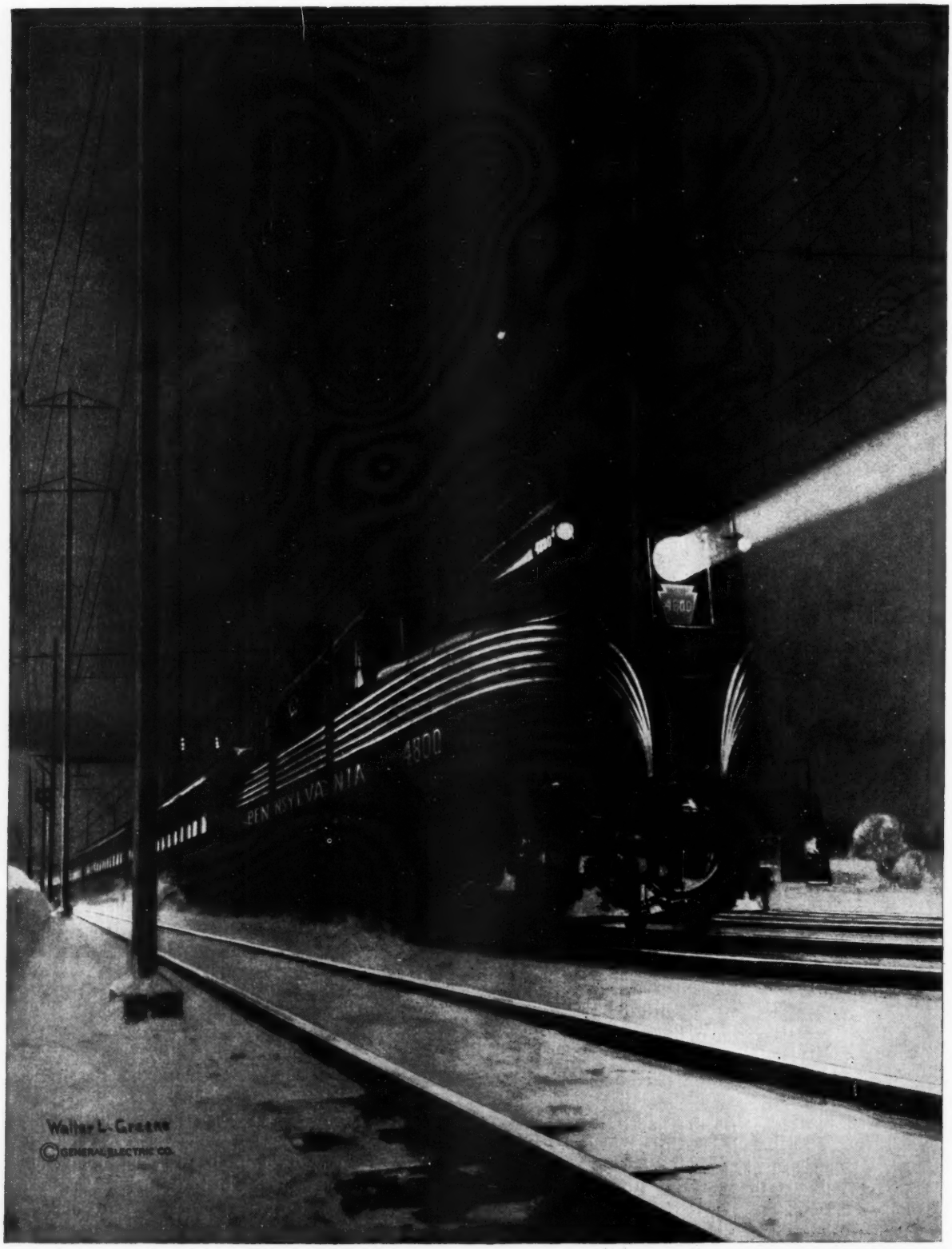


For Greater Speed and Comfort

The
CORNELL ENGINEER

Volume II March, 1937 No. 6

Trends In Engineering Education

by Herman Diederichs
Dean of College of Engineering
Cornell University

Anyone who has been familiar with the development of the field of Engineering Education for say twenty-five years has been aware of the forces at work tending to change the training of the engineer. Pressure has been brought to bear upon Engineering Education from two or three quarters, and it will be of interest to examine the validity of the demands in the light of what the product of an engineering school should be.

Speaking generally, the demands for reform have come from three groups.

The first of these believes that the training of the engineer is in general quite too vocational and utilitarian, and that it must be "liberalized" by the introduction of cultural subjects, generally English and History.

The meaning of "Culture" has been defined a number of times. One of the best definitions I know of was given by W. E. Hotchkiss in a paper before the S.P.E.E. in September 1935. Culture he says, suggests awareness of the world, intellectual curiosity, and capacity for reflective thought. I venture to doubt whether any other body of men in the world possesses these three qualities to the same extent as engineers. Then he goes on to add, however, that culture also connotes understanding, poise, and discrimination in weighing ideas and that it signifies perspective and a sense of proportion in appraising personalities and achievements. Again I submit that in my belief any body of well trained engineers has these qualities to the same degree as a body of lawyers or bankers or business men. Lastly, culture, according to Hotchkiss, implies sensitivity to ethical and esthetic values. If you believe, as I do, that sensitivity to ethical values is an inborn trait, we come down finally to the single item of sensitivity to esthetic values about which there may be a difference of opinion. Assuming that the engineer as a class lacks this, which I am not willing to grant, and assuming that courses in English, History, Dramatics, Music, etc. can fill this need, I am for such courses, but I submit that the enjoyment of all these fields of human endeavor should not be confined to four years of a college course. Enrollment should be for a fifty year course. In any case let's have done with the quite too general statement that the engineer is not "cultured" as compared with the banker or the lawyer.

The second criticism of the engineer's training is aimed at the lack of instruction in human relations, broadly speaking. Here we meet the general charge that the engineer is responsible in large part for the present economic dislocation, principally due to the introduction of labor saving machinery. He is charged with bringing technological development to a peak, and with forgetting to take into account any of the social implications of his work. Here we touch upon a matter in which our defense of engineering education is not so strong. It can be readily disproved that the mere introduction of labor saving machinery is to blame for our present day plight, but enough remains of the charge that the engineer appears somewhat helpless in the face of present conditions. As one of our graduates expressed it, "the present training of the engineer produces a man who stands between capital and labor, and does not speak the language of either one."

It is an implied compliment for the world in general to assume that if the engineer would only concern himself with economics, finance, distribution of goods, etc. that all our economic troubles would disappear in short order, in the light of the fact that professional economists, bankers, politicians, and business men have so far failed to solve the problem. However that may be, it is a fair question whether the present training of the engineer is not seriously lacking in one respect. The problem can be simply stated. E. E. Howard, in an article in the S.P.E.E. Journal, April 1934, said "An engineer is a man who is not embarrassed in the presence of raw materials, and an educated man is one who is not embarrassed in the presence of cultivated and cultural sophistication, i.e. one who is not embarrassed in the company of men and women in any walk of life."

The question for us is whether we do or do not desire the product of our Engineering Schools to be educaed men, and above all men who can do their full share in

the solution of present day problems. The answer seems obvious, the solution, however, not so clear.

Several methods to round out the training of the engineer are on trial in various colleges. The need seems to be for training in history, economics, sociology, politics and government.

Some colleges have done very little along this line, believing that the time available in the four-year course is barely enough to lay a proper foundation for the fundamentals of engineering. In these colleges, courses in English and Economics are often offered, but not much beyond this. This is hardly a solution of the problem.

Other schools have extended this program to include English, History, Economics, Social Problems, Politics and Government, up to as high as 24 credit hours, 16% of the total credit hours of the curriculum.

Finally, other institutions are offering survey courses comprising a correlated cross-section of the History of Civilization, Economics, Sociology, Government, and Current Problems. The most notable solution of the problem along this line is the courses offered at Columbia during the first two college years.

It will be necessary only to compare the second with the third of these solutions. It would seem that the offering of several disconnected courses in History, Economics, and Sociology hardly solves the problem. The student obtains a valuable survey of the fields mentioned of course, but there is no attempt made to correlate the information into a well-rounded whole. It is today practically impossible to divorce economics from sociology on the one hand and politics and government on the other. Hence an attempt to offer them as separate courses can only lead to confusion in the students' minds, unless a given student follows the first courses with advanced courses, in which the whole may finally be integrated. There is not enough time for advanced courses of this type in the four-year engineering curriculum.

The third solution, that of a single survey course, seems, therefore, to offer a chance at much better results. It correlates in one course the necessary information in History, Economics and Social Problems. It avoids specialization in any one of the fields, but gives a general survey of the intellectual work of the world, such as an educated man must have.

The teaching difficulties involved in properly giving such a survey course are, however, very great. It will not do to call upon the services of the various specialists in History, Economics, or Sociology, who may be active in other departments of the University. Such a procedure makes for discontinuity and loses the principal advantage of the course, i.e. the correlation. Neither will it do to place the leadership into the hands of men who do not have a scientific background. It is not necessary that these teachers be engineers, but they should be familiar with the physical sciences and with the technical foundations of our day. Otherwise, the work will lack the correlation that it must necessarily have with engineering, if it is to serve its proper function. Such a course is, therefore, one of great difficulty as far as teaching is concerned, and if the proper faculty is not available, it might better not be presented. If given under the best of conditions, it should go far toward rounding out the engineer's training in a very important direction, and if the teachers are of the type who inspire young men with a desire to follow up leads, the matter of self-education after graduation will be well taken care of. After all, all we can do in a four-year course is to fire a young man with the desire to proceed on his own for the rest of his active life.

The third demand often made upon Engineering Educators is that they develop the technical content of the curricula to higher and higher scientific levels. Since there is only just so much time in a four-year course, heed to this demand runs counter to that made for broadening the training and it becomes necessary to evaluate the two to decide which is the better line to follow.

The circumstance that many people believe that the work of the engineer has resulted in dislocations has already been mentioned. In fact some well-meaning folks have seriously proposed that the world declare a moratorium on further scientic research. Glenn Frank has said that the advances in the physical sciences have brought civilization to the cross-roads where a decision as to our further destiny must be made. It seems to me, however, that there are only two things we can do:

1. Declare a Scientific Holiday, and shut down all the laboratories.
2. Make such adjustments in our Economic and Social Structure as to take full advantage of scientific developments.

There can be no question as to how the decision between these two methods will fall. The former would freeze our civilization at the present level, if it does not mean a steady decline in our standard of living and is unthinkable anyway because one can not stop men from thinking. The second method presents the only way out of the present chaos. I am convinced that what is needed today is not a scientific holiday, but a more intense and a broader program of research. It seems to me that industry needs new products and new processes in order to create work for more people.

A brief survey of recent industrial history indicates this to be the correct conclusion. The depression of 1892-97 was largely reversed by the rapid introduction of the electric light and the telephone. That of 1907 yielded to the automobile and the airplane. And after the war came the new industries dealing with the moving picture, the radio, plastic materials, etc. Since 1930 there has been stagnation. The country needs new industries and the best way to get these is to conduct active industrial research.

Kettering has said that industrial research is an or-

ganized effort to find out before hand what you are going to do when you can no longer keep on doing what you are doing now. That is certainly a forward looking definition, but its import seems to have been forgotten of late. If one should ask me what the next industrial developments are going to be, I could only guess at the answer. I do not know, but that only adds incentive to research.

It may be granted then that we need an intensified research program in industry. Where is the man power for this to come from? Evidently only from the colleges, for industry can not train its research men in fundamentals. And thus we arrive at the justification for the demand that the colleges key up the scientific content of the curricula in order to help train such men.

There can be no quarrel with this except in degree. Not all men entering engineering institutions have the requisite potentialities in inquiring minds and intellectual curosity. Many that do have these qualities have no bent for engineering research but for work in other fields. Now it goes without saying that any engineering course must be kept technically up to date. It must be a living organism, always being adjusted to the demand of the times, but it is a grave question in my mind whether the course should offer the very advanced levels of mathematics, physics, chemistry, analytical mechanics, fluid mechanics, and thermodynamics needed for research experts to all its students, for the very obvious reason that not all of them can take advantage of them.

My solution of the conflicting demands for a broader training of the engineer as a citizen on the one hand and for a more intensive training of the engineer as a research expert on the other, would then be to offer the more advanced technical work only to men who can profit by it. It is not hard to discover who these men are by their work in the fundamental sciences. And in order to train all engineers as broadly as possible as citizens, the more advanced technical work can well be transferred to a fifth year.

In that way we can satisfy the insistent and well-founded demand that the engineering colleges wake up and train men for the job of living rather than merely for the job of making a living, and at the same time send into industry enough trained minds to carry out the new development work that is so urgently needed.

City Engineering In Ithaca

H. W. Eustance, C.E. '24
City Engineer of Ithaca

Courtesy WPA
WPA Lays 2100 Feet of Brick on Stewart Avenue

If being City Engineer of Ithaca is a fair example, there is probably no engineering job more interesting and enjoyable than being City Engineer or Director of Public Works of a small city. There is an endless variety in the work, and interesting and difficult problems are always confronting you. There is a working organization in which you must be a respected leader. You are working for the public, the citizens of the City. You must always be able to see their point of view; their needs must be anticipated, if possible, and their complaints must be patiently received and immediately acted upon.

Government

Ithaca has an elected Mayor and elected Common Council. The Council has all legislative duties and it must appropriate all money, and set the tax rate. It is not, however, an administrative body. Every department, Public Works, Police, Fire, Welfare, and Health, have separate, nonpartisan, appointive, administrative Boards. The Board of Public Works, as its name implies, is the administrative head of the Department of Public Works.

Ithaca has been periodically active in municipal construction and development since 1892. That year was the beginning of a 10-year paving program that saw all the important streets of the era well paved with brick. Some,

Courtesy WPA

Elimination of Bad Corner at State and Mitchell Streets

by the way, 45 years old, still remain with the original surface. Between 1896 and 1898, the sewage system and disposal plant were installed with at least two present Cornell Faculty members cooperating. Prof. H. N. Ogden was resident engineer, supervising construction. Prof. John Parsons contributed some beautiful drafting on the plans. About 1908, flood control work and the improvement of Ithaca's creeks was the program. In 1910, the Six Mile Creek Dam and pipe line, supplying water to the City, was built. From 1910 until 1923, with the exception of 1919 very little municipal construction was carried on. The 1919 exception was a big paving program, when several important streets were paved. By 1923, the Administration realized that the list of long deferred necessary improvements was increasing at an alarming rate, and the thing to do was to organize and start to work. In 1924, under Mayor Sawdon and an aggressive Board of Public Works, the program was launched. Paving Improvements, a storm sewer, sanitary sewer and water extension were first in order.

Street Improvements

The paving program began by paving with concrete and brick the worst of the heavy traffic dirt streets. As the most important of the hitherto unpaved streets became surfaced, we started paving the worst of the old rough brick streets. Attention was given also to the dirt streets that will always be with us. Much street widening, realignment and the increasing of curb radii has been done.

The first paving work in 1924, and in the next few years following, was done by contract. We found, however, that to carry out effectively and economically an expanded program of miscellaneous municipal work, that a skilled working organization of our own must be built up. This was accomplished, and practically all work, such as curbing, sewers, grading, has been done by the City's own forces.

The early paving programs of the city in the 90's had constructed some 10 miles of brick paving on 18 different streets. These old brick streets, now getting traffic which their designers could never have pictured, were rapidly becoming rough, noisy, dangerous to travel over, and very expensive to maintain. It was decided to improve these by resurfacing with a sheet of asphalt pavement, laid directly upon the original brick. Contractors with asphalt plants could not be attracted into Ithaca, so in 1927, the City purchased its own plant for manufacturing hot sheet asphalt paving material, and in the succeeding years have resurfaced three-fourths of the old brick as well as several old macadam streets.

Dirt Street Improvement

Pavements cost much money. It is the most expensive municipal Public Works item to construct and maintain. So there naturally have to remain many miles of streets on which a permanent type of pavement cannot be placed. In Ithaca we made a street improvement plan, placing on the program for permanent type pavement, every street that drew heavy traffic, or which because of its location would receive heavy traffic were it once improved. Then we set about improving the rest. If they had to remain dirt streets, let them be dirt streets that would stand traffic 12 months of the year without too much mud and dust. The first procedure was to drain them. Concrete curb and gutters were constructed along 20 miles of these residential streets. Storm water was led away in a newly constructed system of storm sewers. And, of great importance, every advantage was taken of the opportunity to secure good gravel fill for base and wearing surface of these streets. Ithaca's 10 miles of creeks periodically need cleaning; the gravel removed would be hauled for street surfacing. With the old clay, dirt and cinders removed, and eight inches of creek gravel topped with 2 inches of finer sand and gravel from the City bank, the streets were ready for a surface.

The practice had been to give them an annual treatment with road oil, which policy is still carried out on streets not further improved. But the road oil had so many disadvantages that in 1934, the city started a practice of surfacing the best of our gravel streets with what is known as a "double surface treatment", of asphalt emulsion, asphalt cutback, or tar, and stone. Small appropriations during 1934 and the following two years have enabled us to cover over a third of the streets with what is in effect a very light asphalt macadam pavement. Of course the pavement mat is so light it has to be rebuilt or retreated every year or so, but annual maintenance costs little more than oiled dirt maintenance and the improved results show a very happy comparison.

The City of Ithaca had one of the oldest street railway systems in the United States. It was constructed in 1886. In spite of doubts on the part of Ithacans that such a contraption could climb our steep hills, it did work, and for 35 years was a prosperous and vital transportation system linking the Hill, 400 feet above the town, University Professors, and students, with the town, business, and railroads.

However the railway, being necessary and prosperous, showed the way to later-day public utilities by a program of expansion with little expense to plant and much expense to capital. This was a system devised to bring profits to promoters, losses to investors, and difficulty to the operating company.

After this expansion, the street railway rapidly failed, almost dying, but not quite. A large block of bonds had been acquired by Cornell University, who naturally was interested in saving what it could. Dean Kimball was appointed receiver and for several years tried to keep life in the invalid.

The city streets suffered during this long period of doubt as to the future of the street railway. Of course the railway had not money for street maintenance or track reconstruction, and naturally the railway tracks followed main thoroughfares of the city. The question, "When will the street railway quit?" was the main doubt in street improvement planning.

On those streets that were so bad that reconstruction could not be postponed, trackage was improved at the expense of the city. Although we knew that any month the system might fold, and we would have built-in rails for an abandoned street railway in a so-called permanent pavement. In 1935 the system was finally sold to a company that junked the cars and track and installed modern bus service.

With the ending of the railway the city has turned its attention to improving those main streets where the street cars had run. Stewart Avenue was the first street car street to be so improved. Rails were removed, the roadway was widened and a smooth, wide pavement laid in 1936. A brick surface was laid on Stewart Avenue from State Street to South Avenue, which street is now a main entrance to the University. The rest of the street is paved with asphalt, necessary widening being accomplished by using the land occupied by the railway along side the street as part of the widened roadway.

I do not like to pass over the curb and gutter improvements without more comment. In my mind no municipal improvement produces more for the money invested than the original construction of curb and gutter along an unimproved street. It lines up the streets, establishes grades for walks, forms a parking strip for trees, keeps driveways orderly and confined, prevents standing water, increases the pride of owners in their property, and on the whole is the most welcome improvement that a City Government can offer to property owners.

While discussing highway improvements, I can mention some of the special jobs that have come in that line. Taughannock Boulevard was a narrow road winding down to Lake Shore cottages, when the State graded and paved the route, north from the city line to Taughannock Falls Park. This left a big paving job for us to do. Improvement on the existing route would leave a dangerous railroad crossing. We petitioned the Public Service Commission and got a crossing elimination order, the construction of which in 1934, opened up a new scenic route along the west shore of Cayuga Inlet and along the south edge of the airport.

The State cannot construct highways within cities.

Courtesy Cornell Alumni News

The Old and New of Municipal Transportation in Ithaca

We have long hoped for a change in this rule so as to get some help on our 11 main entrance highways. By a Federal Emergency Measure, some Federal aid was permitted to cities for entrance highways. Ithaca applied for Federal aid on four highways and got one, East State Street paved in 1934 as a Federal-State constructed NRM contract.

Several street improvements were made to make streets more safe. A dangerous curve at the foot of University Avenue was widened in 1928, by digging back into the cemetery, and moving graves after a special State law was passed to permit it. The corner of Mitchell and State Streets, near a right angle corner on a busy hill street, was widened to promote safety and a freer flow of traffic. Some new streets were opened on new rights of way. In connection with our work-relief program in years 1933 and 1934, Cornell and Giles Streets, one and one-half miles long, a bypass route around the southeast corner of the City, were opened and improved. Much incidental work, such as the erection of five miles of guard rail, stone and concrete retaining walls and drainage work, has been a necessity in a highway program accomplishing as much as Ithaca has done in the last 13 years.

Storm Sewers

The storm sewer or street drainage work has not been regarded as incidental, but it has been a major item in our general Public Works program. Prior to 1923, less than two miles of storm sewer existed in the City. Now there are over 20 miles of storm sewers ranging in size from five foot down to 12 inches; 750 catch basins or inlets collect the water into the system. Fortunately for drainage, there are four creeks running through Ithaca, and storm water drainage systems discharge into them without needing large diameter intercepting sewers. In Ithaca, storm sewers are usually constructed outside of the pavement between curb and sidewalk.

Previous to the completion of our storm water sewer system, rain water had to run over ground, in streets and gutters, to find an outlet near the creeks. The long flat downtown streets would receive the swift running flow from the hills and would be flooded curb deep on every rain. Gutters at intersections were deep to prevent the water from spreading, and a drive crosstown was over a series of these bumps which earned the name "thank-you-mams". These have now all been eliminated.

Park Development

Important to the City of Ithaca has been its park development since 1923. In that year, the will of the late Mayor Stewart left his fortune for the development of Stewart Park at the Lake Shore. The years since have seen the development of a fine park. Land was purchased, raised by hydraulic fill, landscaped, roadways were built and recreation activities developed.

The important era of Park development opened, however, in 1933, under Work Relief. To provide good projects for the many men available under the CWA, we planned and carried out a big program of park development, doing work in the Lake Front Area, Golf Course, Airport and Stewart Park, and in Six Mile Creek at Van Natta's Park.

The airport was developed by clearing, filling, draining, levelling, and grading. We constructed a hangar and a paved runway. Sixty acres of big willows and other trees were grubbed out in the development work. Seven miles of under drains were installed. The paved runway, 2,700 feet long and 100 feet wide, has a stone and gravel base and a light asphalt top. Adjoining the paved runway, an experimental turn runway 150 feet has been built. Plots on the runway contain 30 different grass seeds or mixtures. The fireproof hangar has a storage space 80x100 feet with an additional shop and office wing. The entire surface of the field, 115 acres, has been fine graded, seeded with grass mixtures devised by Prof. Johnstone-Wallace, and is safe and usable the entire year. Further plans call for lights for the field, an additional hangar and seaplane ramp.

The golf course project started as a land reclamation scheme, reclaiming the city garbage dump and adjoining swamp land. Using this old garbage dump, the swamp and beautiful woodland along Fall Creek, a fine nine-hole golf course has been developed. The entire lake front area has been opened up for the pleasure of the public. Trails and bridges connect areas divided by beautiful streams. The smoking garbage dump is no more. The Six Mile Park project opened up the gorge and valley of the creek south of the city. Fine trails, unique bridges and steps make this beautifully scenic area accessible. At the lower end of Six Mile gorge a popular swimming and skating pond has been developed at Van Natta's dam. Near at hand is a municipal toboggan slide.

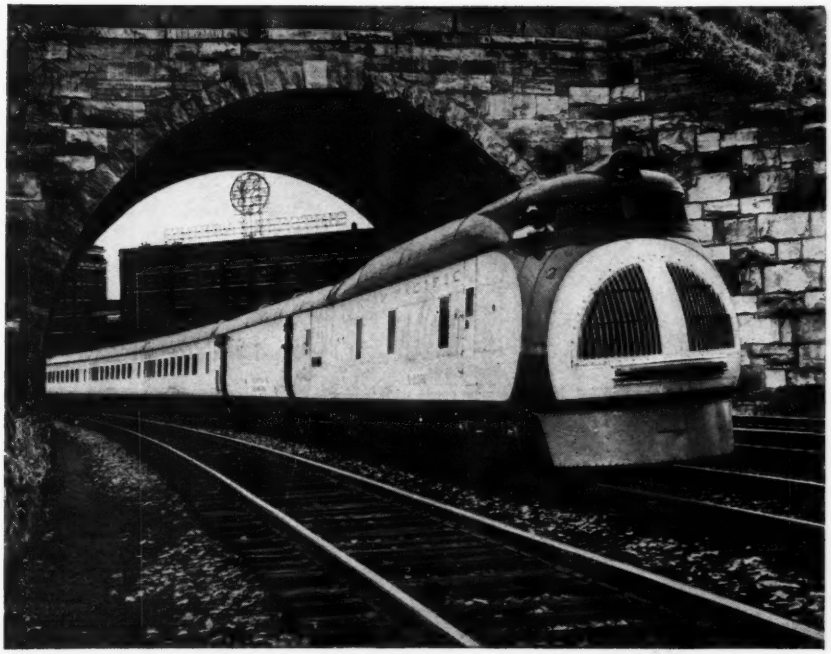
Mosquito Control

Much of Ithaca is swampy low land that for generations has bred mosquitoes possessed of quite normal habits. Ithaca's Park Development program, by filling land, has eliminated all remaining swamp on city-owned land. The filling of private land is an endless job, but as another major work relief project, the city drained all these swamps with eight miles of so-called mosquito ditches. This makes mosquito control easier by eliminating most of the water in the swamps and concentrating it on the cleared open ditches.

Sewer System

Ithaca's Sanitary Sewer system has been extensively improved in a five-year program from 1928 to 1933. The first item tackled was the reconstruction of the Sewage Disposal Plant. The original sewage disposal system in effect on the completion of the original sewers, involved simply screening the sewage and pumping it to deep water in Cayuga Lake via a two-mile pipe line. Because of power costs, this was soon necessarily abandoned and in 1908, old Cameron Type Septic Tanks were built. Be-

(*Continued on page one hundred forty-seven*)



Union Pacific's Streamlined "City of San Francisco"

The Railroads Prepare For Speed

L. M. Genung, C.E. '39

For many years the railroads were stragglers in the modern race for speed. Within the past two years, with the gradual return of business, the railroads have made radical departures from their old course. Competition from the airplane, automobile, and bus forced them to make this gesture. However, before any new train could be sent upon its journey, many things had first to be considered. For unlike the airplane which flies through the uncrowded air, the railroad must confine itself to a narrow route of steel which has many limitations. The first thing that had to be considered was the road-bed.

The two really important problems in which the road-bed is involved are curvature and grade. A high speed train attains a velocity of 60MPH in about 2½ miles, but to increase this velocity up to 85MPH it takes an additional 12½ miles. From this it can readily be seen that a constant high speed must be maintained if there is to be a faster schedule. Comparatively small grades have always cut down the speeds of trains, so in the early construction of most railroads the grades were made as low as possible. To reduce these existing grades would mean the probable relocation and lengthening of the route which would in turn mean a considerable expense.

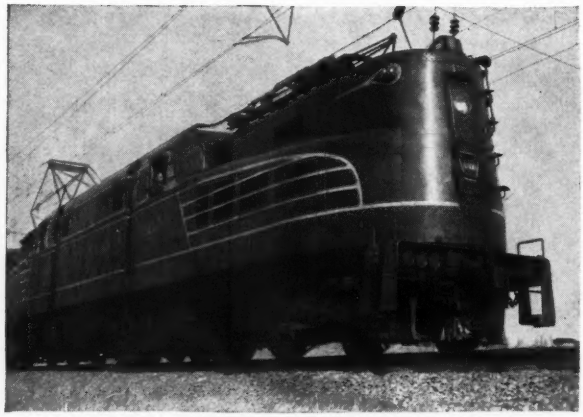
Curvature is the most serious problem that the road bed offers. Theoretically super-elevation can be carried to any height if a constant speed is kept on the curve. However, in the case of railroads all classes of trains must round the same curves. Slow freights moving at rates from 20 to 30MPH have to pass over the same curves that the new 100MPH super-trains travel over. If the tracks were elevated for the 100MPH train only, it is possible that the freight train might drop from the rails. The reverse of the last statement is also true. It has been found by careful research that a super-elevation of 6 in. is the maximum that will permit maintenance of good track for all classes of traffic.

In super-elevation, equilibrium is attained when the pressure between the rails is zero and the resultant of the downward forces passes midway between the rails. The formula used to find this super-elevation is

$$e=0.00066S^2D$$

in which e is the super-elevation, S is the speed, and D is the degree of the curve. This formula would supply comfort for only one class of traffic.

Instead of super-elevating the curves for equilibrium for one class of traffic, it has been found that the curves



Streamlined Electrical Design on Pennsylvania Railroad

may be super-elevated less and still remain comfortable for all classes of traffic.

Mr. G. L. Mercer C.E., Assistant Engineer of the Atchison, Topeka, and Santa Fe Railway, in a recent article on track studies showed that a comfortable curve may be 3 inches lower than the formula for equilibrium would show. In order to find the speed at which trains would round curves without danger and with comfort to passengers a new formula was set up. This formula adds three to the e in the above equation with the following result: $e+3=0.00066S^2D$

If we now solve for S

$$S = \sqrt{\frac{e+3}{0.00066D}}$$

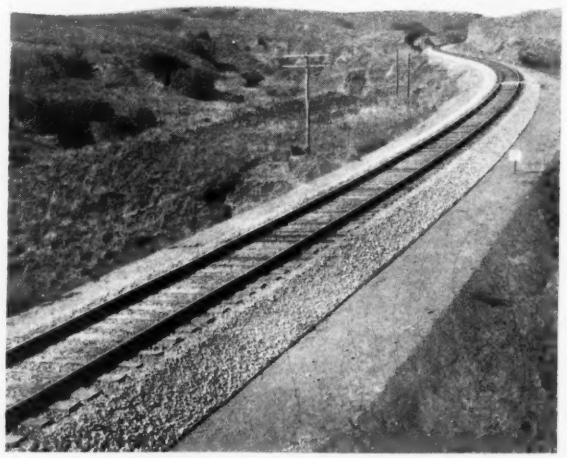
With this formula it is possible to find the speed at which comfort is possible.

It was found from a comparison of speeds that a considerably larger increase of speed is permissible for curves of large radii. Other changes in curves are also necessary. Curves on which acceleration takes place are changed but very little because of the varying rates of acceleration. Spirals must also be changed but due to the involved mathematics these calculations will not be taken up here. It may be said, however, that the changing of these spirals is very expensive because they usually have to be lengthened.

Accessory equipment along the road-bed must be changed likewise. Many of the roads have found it necessary to establish automatic train control. This insures the train ahead from accidents from the rear, for if a train passes a red signal it is automatically stopped. The question of signal spacing is a serious problem. With the increase of speed, new circuits for highways and to towers at railroad crossings become necessary. Accidents as the result of increased speed at crossings can not be tolerated, but if a fast schedule is to be maintained trains cannot slow down for these crossings. By lengthening the circuits to warning signals ample time to clear the tracks is now possible. The difficulty here is that slow freights may delay traffic much longer than necessary but at present this problem is still unsolved. These and many other local and minor problems had to be worked with before a new train could make its first trip.

Now let us consider the train itself. The first things that were considered in the building of the new high speed trains were the possibilities of reducing dead weight and train resistance. To reduce the dead weight of the cars new materials such as stainless steel and aluminum were introduced. By re-designing the cars the dead weight was about halved (standard cars weigh about 80 tons while the new cars weigh about 43 tons) and the space inside was increased. The use of more efficient springs and the lowering of the center of gravity make these new cars as comfortable as before even at the increased speed. The dead weight of the locomotive is more difficult to do away with. This weight has to be kept high so that the starting torque will be great enough to move the train. The power units of the new trains are still very heavy. Lighter equipment is being introduced as fast as possible on all the leading lines of the country but due to the heavy costs it probably will be several years before all the roads will be using this equipment.

Train resistance is due to journal friction, air friction and normal rolling friction. The use of ball and roller bearings and the introduction of several new types of axles have reduced journal friction materially. To reduce air friction stream lining has been effected. This stream lining, as radical as it may seem to the layman, is not nearly radical enough. It is well known that air friction cuts down the speed of trains considerably, but this new half-stream lining has not as yet proved itself to be of great value. It is true however that the new trains have a neater appearance and that the stream lining does furnish good grounds for publicity. Perhaps in the future more drastic steps will be taken to lessen air friction. Normal rolling friction can be kept at a minimum by the



Courtesy Civil Engineering

Such Torturous Alignment Restricts Speed

The Famous 3600 H.P. "Super-Chief" of the Santa Fe Line *Courtesy Civil Engineering*

proper alignment of the rails and by the correct super-elevation of curves as stated before. An interesting note concerning the rails is that they must weigh not less than 110 lbs. per yard to carry high speed traffic safely.

The power for these new trains is supplied in several ways. The most popular means of power appears to be the Diesel-electric engine. An indication of this was the report which showed 50 Diesel-electric equipped locomotives were placed in service or under construction in the year 1935. This is a new production record. All of the early trains were powered by this means. The Zephyrs of the Burlington Route, the Super-Chief, and speed trains on the Union Pacific and Southern Pacific roads are Diesel-electric. Now, however, new types of power are being tried. The Pennsylvania Railroad has streamlined a fleet of electric engines for their New York to Philadelphia route. The Southern Pacific has recently placed a glorified steam locomotive on the famous Daylight Express. The New Haven Railroad is operating a two car, streamlined, steam train which uses oil to heat the water. This latter type power is to be used much more in the future.

The railroads in preparing for speed have also prepared for comfort of their passengers. Before the automobile and bus took away their business, the railroads were satisfied to run any kind of equipment. Now the public demands more, for they know that comfort is possible on the railroads—more comfort in fact than their own car can offer. Much has been done to increase this comfort. The seats in the new day coaches have been made individual. The City of Denver of the Union Pacific Lines has built-in shelves which when they are folded down form a table suitable for playing cards or for doing work. The new Pullman cars have windows in the upper berths. The day of the old-fashioned smoker has also passed. Now a beautiful club car has taken its place. Here the traveler may read the latest magazines, enjoy a smoke or drink, or just sit back in the comfortable chairs and thoroughly enjoy himself. Needless to say the faster schedules have aided the passengers. This added comfort given especially by the western roads has increased the passenger traffic to a remarkable extent. It is difficult to understand why many of the eastern routes have not entered more readily into this new plan. However, the idea is spreading and the increased business proves it to be beneficial to the roads and public alike. We must not criticize the roads too much however for during the depression they were probably hit harder than any other single industry.

Needless to say the improvements that have been mentioned here cannot all be placed in effect at once. It would be impossible to install new equipment and reline complete main-lines in a short period of time. The railroads are working rapidly at this now and in the not too distant future will have installed thousands of new cars and relined thousands of miles of track. The roads are looking farther into the future than the next few years, for in the eighties speeds of 60 miles per hour were unheard of, yet today these speeds are a reality. The new trains are attaining speeds of over 100 miles per hour and in the future even greater speeds may be expected. So the railroads in their improvements now are getting ready for the greater improvements which are to come. They realize that good improvements now may save continual and costly improvements later on. These improvements not only make high speed and comfort possible but also better conditions for all classes of traffic.

After looking over the necessary steps which had to be taken before the railroads could send their new trains over the rails at the new high speeds, it is little wonder that they at first hestitated. The expense of remodeling the right of way and installing new equipment has been very high but the dividends show that they were right in taking this step. Railroad passenger traffic has increased tremendously in the past two years. It is quite evident by this time that the railroad future lies in the direction of improved equipment and modernized rolling stock, particularly if John Q. Public is to spend his pennies for transportation.

The Editor, the Cornell Engineer
College of Engineering
Cornell University
Ithaca, New York

December 4, 1936

Dear Sir:

We have all gone to school at Cornell; we know the handicaps under which the professors and ourselves worked in dusty labs, old classrooms, and in classes too large for efficient instruction; we have read with regret of fine teachers leaving to take positions in private industry; we have seen Cornell engineering prestige take hard raps from newer and better equipped schools; we have read Prof. Hirshfeld's article "Dean Herman Diederichs" (Cornell Engineer, October, 1936) deploring these and other conditions; we want to see Cornell engineers keep and surpass their place in the sun; we may even some day look around for a place to send our sons to school--what a pity if we must pass up Cornell because we didn't act today! For words are fine, but actions are what pay the professors and put equipment in the laboratories.

How? Take this year for what it is worth. Let's become Dollar A Year Men. Let each one of us who can subscribe immediately a dollar for each year since our graduation. And the same next year, and the year after - till the old reaper busts us out of his school. For those upon whom Dame Fortune has beamed more broadly, let them subscribe two, three, or more dollars per year.

Let the faculty do with it as they feel best- whether they increase their own salaries, hire new men, buy new equipment, or possibly even hire a professional Hat Passer to pull in some big money (Time, November 16, 1936; page 86). While we are about it maybe we can interest a few "Mr. Smiths" in the Cornell College of Engineering.

LET'S GET GOING!

Anderson
Cornell C.E. '32

Got so hepped up that I doggone near forgot to enclose my dollar per year. I put it in trust with you till some plan and organization may be worked out.
And don't forget the general Alumni Fund in the heat of engineering partisanship.

New Engineering School?

Several years ago, an anonymous gift of ten thousand dollars established what is known as the Engineering College Endowment Fund. The purpose of the fund is to further the interests of the engineering college, acting as a supplement to the University funds.

For years Cornell has stood for the highest in engineering instruction and research. With time, though, the facilities have started to fall behind those of contemporary schools. At present, to overcome this disadvantage, an active study is being made of college building plans. This will, of course, involve large sums, and the money will have to come to a great extent from large donations.

To maintain what we have and will acquire, though, the College Endowment Fund must be augmented by small contributions.

To this end, a very interesting letter has been received from Mr. W. M. Anderson Jr., which is herewith reproduced. It is most heartening to see the spirit shown in this letter, especially by such a recent graduate. Of course, it is quite natural that this spirit is not shared by all the alumni, especially those who rarely return to Cornell and who, in the rush of their own affairs, forget the old college. There are many, though, who are as interested in the Cornell College of Engineering as Mr. Anderson and from these men we should like to hear comments on Anderson's plan.

Five thousand dollars has just been granted for a study of new Engineering Buildings. Is that money to be wasted because of a lack of follow up funds?

EDITORIALS

A RETURN TO LIFE

After several years of marking time and making entries on the red side of the ledger, the railroads have begun once more to take an interest in the traveling and shipping public. Their dormant competitive instinct at last aroused, they have thrown away their crutches, taken an extra notch in their belts and done a real job of engineering. Changes in road-beds, revision of block signals, new crossing signals, new yard layouts and, last but not least, higher speeds and greater comfort for the passenger on the train have been the order of the day. The latter of these two items is really the focal point of interest as far as the passenger is concerned. Streamlined trains and modernized equipment have evidently begun to turn the interest of John Q. Public from his use of the highway back to travel by rail.

It is only natural, of course, that the public should be appreciative of scientific development applied to transportation. Thus it is difficult to understand why, with the example of the automobile and airplane industries before them, the railroads have been so slow to adopt modern scientific improvements. There is, of course, a great amount of inertia connected with an industry as large as the railroad industry in this country. Replacement of costly rolling stock is a problem in itself and the replacement and maintenance of road-beds is time-consuming and expensive. Under the leadership of the aggressive western roads, however, modernization of the railways in this country is proceeding at a rapid pace. The railroads have found that improved equipment not only pays extra dividends, but actually cuts down operating expenses. The novelty of luxury transportation has so appealed to those that travel that the various streamlined trains now in operation are not only reserving space several days ahead, but sometimes weeks ahead of scheduled trips.

Streamlining for passenger traffic is not the only work being carried on by the railroads. There is also a definite attempt being made to better the existing freight schedules and rates. Faster freight movements are being made. New and better rolling stock is being constructed with a consequent improvement in freight conditions for perishable goods and urgent loadings. More freight cars are on order at the present time than at any corresponding date since 1926. Freight loadings for the week ended February 13 showed a gain of 10% over the same week of 1936 and an increase of nearly 20% over the corresponding week of 1935. Offhand it might look as though the railroads have begun to try to cash in on science in the same manner that the other industries have done in the past. There is no doubt but that modern engineering can produce a goodly number of improvements, and the railroads have been finding recently that these improvements not only pay but pay well . . . A short summary of the modernization work being carried on at the present time is presented in an article in this issue.

—o—

C.I.O.

The current series of strikes, which have added tens of thousands to the ranks of the unemployed through the action of a loud-spoken, ambitious minority intent on controlling the labor policies of the whole working forces, should interest engineers throughout the country. It is because the engineer is so closely concerned with production and because many engineering graduates enter administrative jobs that they are affected by and should be interested in acquainting themselves with the present situation. Many engineers are in positions where they will have to deal with threat of strike and the consequent problem of protecting the bulk of their employees should the epidemic of dissatisfaction spread as many insist it will.

One of our largest manufacturing concerns has successfully frustrated the attempt by the Committee for Industrial Organization to force itself on the workers as the sole bargaining agent for all of the employees of the company. Another company is apparently finding a settlement of the problem without a strike. As this publication goes to press, the steel industry is lining up to affect a peacable settlement also but again without granting the apparently unfair demand that the C.I.O. represent all of the employees. This demand is so unjustified that it seems that it can only have been used as a bluff, to try to frighten the employers into granting other concessions in return for the dropping of the demand.

The majority of the employees in the companies affected do not want the C.I.O. dictating whether they shall work or not. They do not want the C.I.O. as sole bargaining agent for them. It might, therefore, be a wise move if the officers of important concerns, through the medium of company advertising, expose these outrageous demands and what they mean to the majority of the employees. The thinking workers and the public which is indirectly concerned would soon see to it that these demands would not be supported. Public opinion is still an important force in this country.

There has, of course, been a rise in living standards although the wages in some industries have not risen to meet it. If this necessary rise in wages is brought about by the recent attention given to labor conditions, the result is good, but if it is a result of granting such demands as the C.I.O. professes to hold up, harm will have been done to both industry and the men employed in it.

Do You Know These Men?

W. H. PETER, JR.

J. J. SERRELL, JR.

With a well rounded background of success in athletics, scholarship, and committee work at Cornell, Wilbur Howard Peter, Jr., '37 AE, EE, is headed for the top in the engineering profession. Bill hails from Lakewood, Ohio, where he was a member of the High School track and football squads. Entering Cornell in 1933 he decided that the key to success was to stress scholastic work during the first two years, and in case you don't agree, just look over his record.

In his Freshman year Bill was a member of the Frosh Track Team and the Freshman Banquet Committee. The next year he became a member of the Varsity Track Team, the Sophomore Smoker Committee, and was elected to Kappa Tau Chi. Following this he was made a member of the Junior Blazer Committee, President of Red Key, and a member of Tau Beta Pi. Still running on the Varsity Track Team and a member of Spiked Shoe, Bill is now President of Sphinx Head, Chairman of the Junior Week Committee and a member of the Student Council.

With graduation not far off Bill is trying to decide just what field of engineering he will enter. He hopes for production or sales engineering work with one of the smaller concerns where, he feels, the opportunity for advancement is somewhat greater, and a more personal atmosphere exists. Perhaps he will return to a former summer employer, an Ohio crankshaft manufacturer, from whom Bill learned the ins and outs of the Tocco Process, a method of case-hardening which is done electrically in 15 seconds without the use of compounds.

A three months' trip abroad occupied Bill's last summer vacation. He visited Germany, Holland, Austria, Italy, Switzerland, France, and England, and other smaller countries. His stories of the Dolomites of Italy which glow a lustrous red in the sun, the old castles of Germany, and shooting the rapids in a falt-boat should appeal to any lover of adventure.

If the past can predict the future, John Jacob Serrell Jr., '37 ME, now completing a very successful four years at Cornell, may look forward with assurance toward the life he will face upon leaving.

Because his father is a Cornellian, ME '10, Jack naturally came to Cornell after graduating cum laude from Pingry School, Elizabeth, New Jersey, where he played football and captained the rifle team. Upon arriving at Cornell, he pledged his father's house, Seal and Serpent, and is now president.

Always interested in athletics, at Cornell Jack switched from football to lacrosse, making the varsity lacrosse squad his sophomore year and earning his letter during his junior year. In addition he returned to rifle competition as a sophomore and is now captain of the rifle team.

Jack has probably more extra-curricular activities and accomplishments to his credit than any other engineer, and in addition, stands second scholastically in his class. His activities include secretaryships of: Tau Beta Pi, Atmos, and Scabbard and Blade as well as memberships in: Quill and Dagger, Phi Kappi Phi, and Pi Tau Pi Sigma.

Last summer Jack spent an interesting two weeks doing research work for his father in conjunction with the use of polarized light for automobile headlights. The remainder of the summer was spent commuting between his home in Elizabeth, New Jersey, and Ithaca, making arrangements for the 1937 Freshman Camp, of which he was director.

Jack's attitude here at Cornell might be classed as efficient enjoyment. He has at all times carried as heavy an academic load as anyone, done twice as much outside work, and attended three times as many conventions. This ability to handle so much and yet always have time to be a real chap should carry him a long way in life.

COLLEGE

ASME MEETING

The latest meeting of the Cornell Student Branch of the A.S.M.E. consisted of student lectures. The lectures were strictly competitive and the winners were announced following a short sitting of the judges. First place was awarded J. G. Nutt, ME, '37, second and third honors were taken by R. L. Boyd, ME., Special, and J. Breslove Jr., ME, '37, respectively. Each of the three was given a book for his fine work.

The winner, J. G. Nutt, will represent the Cornell Student Branch at a section lecture contest of the A.S.M.E. which is to be held in April. His subject, "Machine Shop Inspection", was well explained. It consisted of a summary of the methods of inspection, step by step, of various parts of a simple link. Boyd's topic, which was "The Psychological Aspects of Air Conditioning", told what air conditioning must accomplish and its effects upon health. "Superposed Steam Plants", which was Breslove's selection, consisted of possible methods of increasing the output of existing steam plants to meet the present-day demands.

Additional speakers and their topics were P. B. Rutan, ME, '37, who spoke on "Advantages of Freon as a Refrigerant"; G. Philipp, ME, '37, who enumerated "Difficulties Encountered in Making Sheet Metal", and G. C. Brainard, ME, '38, who discussed "Radial Engines for Military Purposes".

U. S. SOILS ENGINEERS

This fall saw the establishment of a branch of the U. S. Soils Engineers in Lincoln Hall. Their work is performed largely for the purpose of determining the suitability of soil upon which structures might possibly be constructed. Thus far no definite results have been obtained, mainly due to inadequate laboratory equipment and because they have been established such a relatively short time.

Plans have been proposed for a building on Tower Road and construction is expected to proceed soon.

COLLEGE OF ENGINEERING DINNER

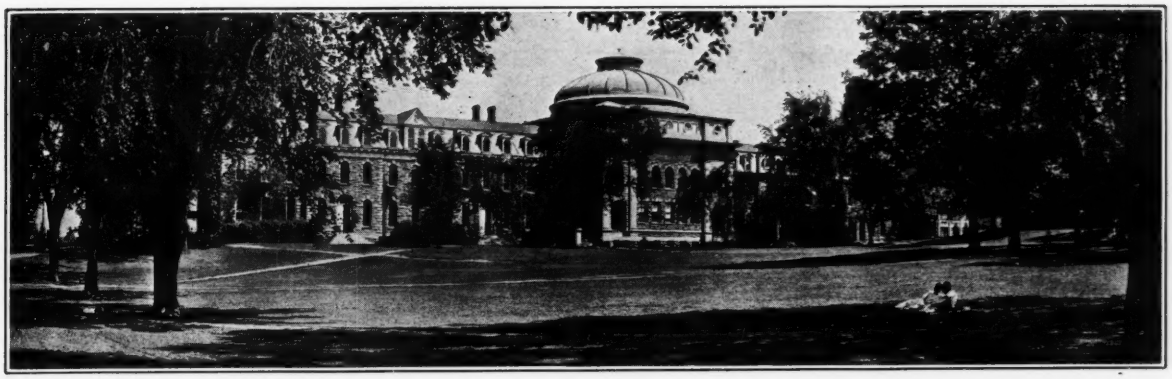
The first Annual Honor Day Dinner of the College of Engineering will be held in the Memorial Room of Willard Straight on March 30. Dean Herman Diederichs will preside. The guest speaker of the evening will be Dean J. W. Barker of the Columbia University School of Engineering. Although the primary purpose of the dinner will be the observance of Honor Day, it will also serve to further friendship between the students and the faculty.

The celebration of Honor Day is the result of action taken by the faculty of the college last April, in voting to recognize outstanding attainments among students in the Engineering College by the preparation annually of an Honor List to be submitted to the Dean. Here will be listed the names of those students who have high standing in their respective classes, with special mention of Seniors who have been consistently on the list throughout their courses. Seniors on the Honor List shall have special mention on the Commencement Program. At the discretion of the faculty, in exceptional cases, the name of the Senior who has accomplished some creditable piece of research, or who has not been on the list his first two years but has shown marked progress and real ability in his last two years and attained high rank in senior year, may be added to the list.

The 1937 Honor List for all four classes will be announced at the dinner.

DEXTER S. KIMBALL

Since Dean Kimball's retirement of last year, there have been many conjectures as to his activities at the present time. The nature of these activities is perhaps best indicated by a short summary of his work since his "retirement'. The magnitude and variety of accomplishments puts even the most active undergraduate to shame. His principal job has been his membership on the inspecting committee of the Engineer's Council for Professional Development which is examining all of the engi-



NOTES

neering schools in the United States for the purpose of making an accredited list for the use of state licensing boards and engineering societies. In the last few months this committee has examined nearly all of the engineering schools in the northeastern part of the country.

In November he was one of four prominent speakers at the Centennial Celebration of the Patent System held in Washington, D. C. The paper he presented at the convention along with the three others is to be included in a memorial book of the Patent Celebration.

Since his retirement he has given addresses before students of Princeton University, University of Maine and the University of West Virginia. He has spoken before engineering and industrial groups in Philadelphia, New York, Binghamton, Elmira, and Toledo, in addition to numerous Cornell organizations throughout the country.

In addition to serving on the Inspecting Committee, Professor Kimball is Chairman of the Board of the International Accountants Society, Inc., a director of McGraw Hill Publishing Co., of the Ithaca Savings Bank, Ithaca Industries, Inc., and President of the Ithaca Community Chest.

In summing up his activities, the former dean adds that, "aside from these and a few other distractions I am leading a peaceful and 'retired' life."

UNIFORM CUT SYSTEM

At a recent meeting of the faculty of the College of Engineering, a new uniform system of penalties for unexcused absence from classes was adopted for the Engineering College. After some lengthy discussion the following plan was adopted: the deduction from the final grade will equal the number of absences from class divided by the total number of meetings of the class times a constant factor 60. (C/N x 60). The second part of the plan states that any person who has more unexcused absences from a class than the number of credit hours given for the course plus one, will be automatically dropped from the class rolls. For example, if a person has three cuts in a course in which there are fifteen class meetings per term the deduction from the final grade will amount to 3 divided by 15 or one-fifth of 60 which equals 12%. Thus if his term mark were 75% his final grade would be 63%.

This rule is to be uniform throughout all three engineering schools and is to go into effect immediately, the deductions taking place at the end of the present term.

LARGEST PORTABLE TELESCOPE

Cornell now possesses the world's largest portable telescope. S. L. Boothroyd, Professor of Astronomy, and R. W. Shaw, instructor in physics and astronomy, designed the instrument. It has a 24-inch mirror, being twice the size of the one at the Fuertes Observatory. The mirror will be aluminized by a special process developed at Cornell by R. C. Williams '31. The portable frame is constructed of duralumin so that when dismantled, it can be carried by pack train or by men.

Because of its portability, the instrument can be carried to altitudes hitherto barred to large telescopes. From these altitudes it will be possible to compare the light reflected from the earth's surface with that from the surface of the moon, the stars, and the planets. These comparisons will give new information about the universe. Funds are now being raised to construct a clock-driven mounting of the telescope.

ALDERMAN EDUCATOR

Professor John E. Perry of the Civil Engineering School was recently made the Republican chairman of Tompkins County. He was elected as a compromise candidate to restore harmony in the county organization. Professor Perry has been active in politics for many years, both in the party organization as a district committeeman and in the city government as an alderman.

(*Continued on page one hundred forty-four*)

President's Column

March 2, 1937.

Fellow Engineers:

Among the recent graduates of the College of Engineering at Cornell there are doubtless a certain number who are convinced by a few years of work after graduation that there is some other field of endeavor that would suit them better than technical engineering.

There are, no doubt, some undergraduates who have reached a somewhat similar conclusion. To such men I offer the thought that graduates in engineering from Cornell are fitted to undertake many other kinds of work than those which we are accustomed to think of as belonging within the field of engineering. Professor Bangs, in the address he made before the Society last fall referring to a questionnaire sent out to recent graduates regarding their present occupations, said: "I am amazed at the versatility of our men."

Why should not men graduating in engineering from Cornell go into almost any department of any business? With the training he has received, an engineering graduate should be able to gain enough insight in a comparatively short time to enable him to start in almost any line that appeals to him. After the start is made, he can augment his knowledge in his chosen line of work with much greater facility when he is actually engaged in it than he would have done by studying it abstractedly without any close contact with it.

The principal criterion which I would apply would be that the work undertaken should be of real interest to the individual. If that happy condition is achieved, his work will be a constant source of satisfaction to him.

Many of my Cornell engineering friends have made good in fields not at all closely related to engineering. If any recent alumnus or any undergraduate has the idea that the die is cast and he is in for a life of technical engineering work just because he is taking (or has taken) an engineering course, I would urge him to discard this idea if at this date he feels that engineering work does not appeal to him and to substitute for it the thought that almost the whole field of human activity is available to him.

Sincerely yours,

J. D. TULLER.
President

KAYO saved the day

A CHURNING flood had taken out the telephone line across a Colorado stream. Repairmen couldn't wade it because of quicksand—couldn't cross elsewhere and bring back the line because of obstructions.

Then Kayo's master had an idea. He went upstream, crossed, came back and whistled. Kayo jumped in—swam across with a cord tied to his collar. With this cord, the wire was soon pulled over—communication was restored.

A small incident. But it typifies the ingenuity which helps Bell System men and women to give you the world's most dependable telephone service.

BELL TELEPHONE SYSTEM

Why not telephone home more often? Rates to most points are lowest after 7 P. M. and all day Sunday.

Alumni Notes

'10 CE—Harold T Critchlow recently completed a special assignment as regional coordinator of the National Resources Committee on the drainage basin study for the United States, the report to be presented to the President this month. He is chief engineer of the New Jersey Water Policy Commission with offices in Trenton, N. J.

'10 ME—Frank R. Oates is managing director of Technicolor Limited of England. He has completed his first Technicolor British picture and they have recently completed new color film laboratories.

'17 CE—Arthur W. Mellon Jr., has been appointed assistant treasurer of the Metropolitan Life Insurance Co.

'21 CE—Mrs. Franklin N. Corbin, Jr. (Margaret Arronet) lives at 7546 Ellwood Avenue, Chicago, Ill. She has three children.

'23 CE—Felix E. Spurney, with the Turner Construction Co., of 420 Lexington Avenue, New York City, lives at 10 Calvert Place, Kensington, Md.

'23 ME—Alfred H. Marsh is manager of the sales construction dept. of the Sun Oil Co., 1608 Walnut St., Philadelphia, Pa. For 12 years he was with the Sun Oil Co. in Florida. His home address is 606 University Place, Swarthmore, Pa.

'24 ME—A third son, Richard Davies Lewis, was born on October 10 to Mr. and Mrs. Howard B. Lewis (Dorothy Davies, '24 AB). Their address is 7810 Nardian Way, Venice, Calif.

'25 ME, '26 MME—Robert P. Mason is with the Mason Box Company, manufacturers of jewelers' boxes, cases, cards, and mailing boxes, Attleboro Falls, Mass.

'26 ME—Paul E. Rapp is an investment analyst with the Manufacturers Trust Co., 55 Broad Street, N. Y. C. He has been married since 1929, has two children, a daughter, five and a son two years old. His address is 890 East Thirty-Fourth St., Brooklyn.

'27 ME—Edwin B. McCrohan Jr. has moved from New York City to 81 Kennedy Ave., Rockville Center, L. I., N. Y.

'27 EE—Bertram G. Trevor, son of Prof. Joseph Trevor, was in charge of the complicated receiver in the television show in the Empire State Bldg., New York City, recently. Trevor is a research engineer with the Radio Corp. of America.

'29 CE—John D. Russell is electrical engineer for the Joy Mfg. Co. in Franklin, Pa., designing coal mining equipment.

'29 CE—William N. Young, who was formerly employed at the Shell Oil Companies Office in San Jose, Cal., has been transferred to Redwood City, Cal.

Alumni Notes

'30 CE—Harry L. Hilyard is with the American Tobacco Co., 111 Broadway, New York City.

'31 CE—B. Otto Roessler is still with the Bureau of Reclamation; his address is 1220 Marion St., Denver, Col.

'33 ME—Charles H. Hutoon Jr., formerly of Cleveland, Ohio, has moved to Detroit where he will take up his duties as sales manager of the Norma-Hoffman Bearings Corporation.

'33 M.E.—L. I. Otto is floor foreman in charge of labor and machines, manufacturing specially processed gypsum plaster boards for the U. S. Gypsum Co., Chicago.

'33 M.E.—C. S. Schick is at work in the physical testing lab of the Eastman Kodak Co., Rochester. His address is 656 Averill Ave., Rochester.

'34 A.E.—W. H. Cook is with the N. Y. Edison Co. Inc. taking economic and statistical studies in connection with power plant operation. He may be reached at 8950 Colonial Rd., Brooklyn.

'34 A.E.—T. R. Crowley is with the Libby-Owens-Ford Glass Co., Ottawa, Ill. He is in charge of two experimental furnaces making heat treated glass.

'34 B Arch—Edgar C. Taylor is associated with William Vaughan, architect, in Saratoga Springs. His address is 131 Lake Avenue.

'34, '35 CE—Eddie G. Borpesson is in Latrobe, Pa., as resident inspector on spillway construction for the Northeastern Water & Electric Service Corporation. Last summer he toured the South and Middle West. His address is 114 Miller Avenue, Sayreville.

'35, '36 CE—Herberg P. Orland is a Second Lieutenant in the Seventh Field Artillery at Fort Ethan Allen, Vt.

'35 ME—Richard K. Keiser is working at the Naval Air Factory in the drafting department. At present he is doing design work on new (very confidential) pursuit planes to be used on the Navy's airplane carriers. His address is 1922 Spruce Street, Philadelphia, Pa.

'35 B Arch—James M. Kittleman II is with Burnham Bros. & Hammond, Inc., Chicago, Ill., architects. He lives at 1602 Hinman Avenue, Evanston, Ill.

'36 EE—Morton Mathew, Alexander C. Wall, Llwellyn W. Collings, Charles H. Leet, Walter L. Chewning, Francis R. Fowler, and Frank W. Brower are all employed in the test course at General Electric Co.

'36 ME—Cecil L. Burton is doing test work in the development department of Firestone Tire & Rubber Company. He stays at the YMCA, Akron, Ohio.

'36 AE—Harvey W. Ellis is with the General Cigar Company in New Brunswick, N. J.

College Notes

NEW ENGINEERING BUILDINGS

(*Continued from page one hundred thirty-eight*)

In January the Board of Trustees voted $5,000 to draw up plans for new buildings for the College of Engineering. Schreve, Harman and Lamb, architects of the Empire State Building, have been commissioned to submit plans. The estimated cost for the buildings is about $3,500,000 plus an additional $1,000,000 for new equipment.

LECTURE-DEMONSTRATION ON RESEARCH

At a meeting sponsored jointly by the AIEE, ASCE, and the ASME, on March 10, Dr. Phillips Thomas, who is associated with the Westinghouse Electric and Manufacturing Company, gave a unique lecture-demonstration in Baker Laboratory.

Dr. Thomas, a graduate and former professor at the Engineering School at Ohio State University, explained that audiences are no longer thrilled by the mere demonstration of ordinary electrical phenomena. "So," he said, "I will talk of the men who are responsible for the application of these phenomena — the men who have, through long years of hard work and the drudgery of research, perfected the talking movies, television, and the instruments used for blind flying."

He delivered his lecture through a public address system, using a small lapel microphone. As he later pointed out, research engineers have so perfected the public address system, that some in the audience were unaware that one was being used.

The first demonstration was a device used commercially in conjuction with air conditioning apparatus. It is an electric filter which removes all solid particles from the air, by charging them to a high potential, and collecting them on grounded plates. Dr. Thomas blew cigarette smoke through the device, and the audience was amazed to see it actually "disappear" before its eyes. This filter has been used to remove dust and pollen from the air in rooms, where patients suffering with asthma and hay fever were confined.

Transformer oils furnished the basis for another topic. To avoid dangerous explosions in street manholes, caused by "stewing" arcs in oil-filled transformers, Westinghouse research engineers set about to discover another type of cooling medium. This coolant was perfected only within the last month. Inertine, the fluid developed, has as good dielectric strength, cooling properties, and power factor, as ordinary transformer oil, but does not yield explosive gases, when an arc occurs. Dr. Thomas predicted the coming of dry transformers for large network distribution, since a new insulation, capable of withstand-

College Notes

ing temperatures as high as three hundred degrees, Centigrade, is under the process of development.

He also showed the uses of the stroboscope in studying rapid motion; the Ignitron tube, used in welding control apparatus; and the light relay, utilizing the phototube, in connection with a cold cathode glow tube relay.

In conclusion Dr. Thomas pointed out that research workers are free to use any available methods to arrive at the desired results. "In college," he said, "you are not allowed to enter an examination with notes on your cuff, but if a research engineer solves a problem by the use of such notes, more power to him . . ."

SNOW MAIDEN

About once a year the architects awaken from their lethargic vigil atop White Hall and descend on the quadrangle for a breath of air. The sudden change in pressure must stimulate them considerably, for it usually results in some prank being played. Last year we were given the Capitalistic Parade; last term those footprints on the campus walks.

So it was that Mae West came to grace our quadrangle last snowin' time, in the form of a ten-foot snow maiden. There was no mistaking who was represented—there was a sign at her feet.

That sign was the item that should have caused a riot. At least, so the mad architects thought. Some days later we learned that they were assembled en masse at the scene of their brain child, daring the Engineers to come and atone for the insult ascribed on the sign. Now the idea of so enhancing the relations between our two schools is a good one, but may we suggest that suitable announcements be sent out next time. The architects assembled just as classes changed and looked so like a section of Math. 5b, that their presence went unnoticed.

PHI KAPPA PHI SCHOLARSHIP

The Cornell chapter of Phi Kappa Phi has established a scholarship for Graduate students, Professor M. G. Malti, president of the chapter, has announced. The stipend will be fixed yearly by the executive committee of the chapter, and for the year 1937-38 will be $150. It will be awarded by the Faculty of the Graduate School, preferably to members of Phi Kappa Phi.

The Board of Trustees, in accepting the scholarship, have authorized free tuition in the Graduate School to its recipient.

Students may apply directly, on forms obtainable at the office of the Graduate School. Nominations from Faculty in the Graduate School will also be considered.

Correspondence

Editor, The Cornell Engineer,
Cornell University, Ithaca, N. Y.

Dear Sir:

I was very much interested in the leading editorial in the February,1937 issue of the Cornell Engineer, headed "Culture and the Engineer." This subject has been discussed for many years in the Engineering College Council.

For the purpose of provoking some comment and discussion from other Engineering Alumni, I would like to set forth my personal views.

Engineering colleges will, I believe, have two distinct groups to train; one consisting of those whose proclivities are purely technical, whose undergraduate courses will lean heavily toward the technical side without over-specialization until graduate courses are reached —the type who take kindly to the ramifications of external and internal stresses, internal combustion, fourth dimensions, etc.; the other typified by what we now call the "Administrative Engineering Group," who will receive a thorough grounding in mathematics, sciences, fundamentals of design and other things that are basic in Engineering, together with courses and reading in the so-called "liberal" sciences, leading to corporate, executive, and governmental activities—men who will deal as much with social, economic, and human forces as with physical forces.

We quarrel with the popular misconception that engineers are a narrow-minded lot. They are not narrow minded, but their reading, thinking, and activities are frequently within such a narrow range that it circumscribes their opportunities for shaping important policies and in directing social and governmental enterprises. It is true that many engineers reach positions of high executive responsibility in industry, but too few a number obtain this goal. Why is it that so few engineers become members of the president's cabinet?

I would like to see more engineers in such activities. I should also like to see more of them heading chambers of commerce, boards of education, civic budget commissions, and charity organization societies.

One lesson that the depression taught us was that, while engineers had accomplished wonders in solving the production problem, neither engineers nor any other group had solved the distribution problem.

An engineering college can perform a useful service for society, as well as attract favorable public attention to itself, in training engineers not only for outstanding technical endeavors but also to exert their proper influence in economic and governmental affairs.

Yours very truly,

CHARLES M. CHUCKROW, C.E. '11

Engineering In Ithaca

(*Continued from page one hundred thirty*)

cause of a peculiarity in Ithaca's sewage, in which sludge formed scum and floated, rather than settled, the tanks were very effective.

In 1928, a system, with modern settling tanks, with mechanical sludge collectors was installed. Pumping equipment was renewed with three large non-clogging centrifugal pumps, sludge pumps and a venturi meter. The following year sludge digestion tanks, drying beds and gas collection apparatus were installed.

The next item on the program was the construction of two intermediate sewer lift stations and a system of collecting force mains serving the southwest corner of the City. In the larger lift station at Buffalo and Meadow streets were installed new pumps and a bypass main. Altogether, nine new sewage and two sludge pumps have been put into operation. In a 40-year-old sewer system many trunk mains become overloaded. Several new relief trunk mains have had to be built. In 1924, many sections of the City could not be served by the existing sewer collection system. Now after the construction of nine miles of additional mains, there remain only five houses that cannot be served by the city sewer system.

A rainstorm of cloudburst proportions dropped seven and one-half inches of water on Ithaca in 13 hours during the night of July 7 and 8, 1935. This deluge caused every creek to run riot, destroying bridges, undermining creek walls, and flooding buildings located near the streams. One-half of downtown Ithaca was under water. Six hundred families driven from their homes by the rising flood were housed in the University Drill Hall.

Relief came from State and Federal agencies and the Red Cross. Families were taken care of, and then the long pull of repairing the flood damage was started. Damage to private and public property was estimated at three-fourths of a million dollars. For a year and a half the city has worked to restore the damage to public property, streets, parks, creeks, and walks, and the job is not yet complete.

Flood control studies are being made by the Army Engineers to devise protection to Ithaca from future floods of similar magnitude.

Bridges, Creeks and Floods

Through the City of Ithaca flow 10 miles of creeks. These present problems in channel and creek wall maintenance, bridges, floods, and ice jams. In July, 1935, the City suffered a disastrous flood. Some of the damage is still being worked upon 18 months later. As well as damage to private property from flood waters, the creeks themselves suffer from such a deluge. Creek walls are undermined, dikes cut and washed away, channels are filled. Flood control studies must be made and projects advanced to prevent a repitition of the disaster.

There are 29 traffic and four major foot bridges in the City's bridge system. A program of bridge renewal was started in 1926 which has resulted in the replacement of 15 old bridges and in major improvements to 10 others.

The filtration plant constructed in 1905 is giving faithful and modern service, despite its age. Only recent improvements to the process of filtration have been the addition of taste and odor control treatment. The pumping station has been entirely rebuilt and modernized, however. Hydraulically driven centrifugal pumps have been installed, replacing 30-year-old pounding piston pumps. Filtered water storage capacity has been more than doubled with the construction of four new reservoirs and standpipes. Very important improvements have been effected in the distribution system. Many miles of new mains serve new customers, reinforce the fire system, eliminate dead ends. New hydrants and valves have modernized the system.

In the City Engineer's office in Ithaca, planning is done for all these improvement programs. The work under construction is supervised by the Engineer. Besides such construction as outlined above, a great variety of miscellaneous work comes the Engineer's way. He is a Planning and Zoning officer. In Ithaca the Engineer's office has compiled tax maps of the entire City, which furnished the basis of an equitable tax appraisal. Records of all City improvements are kept, public improvement assessments are mapped and levied. And quite an important service is that the Engineering office is a source of information to the public.

Courtesy Ithaca Chamber of Commerce
Stewart Park at the Head of Cayuga

City Engineering in Ithaca is a fascinating vocation. To be in on a development program that has so changed for the better the physical appearance of a naturally lovely city, and have had a part in improving sanitation, increasing safety and furnishing recreation to the enlightened citizens of a fine college town, and to have worked with fine mayors and intelligent, unselfish and non-political city administration, is a career to be envied. It has been fun; it has seemed important; we have enjoyed the past, and look ever to the future.

STRESS and STRAIN

THE ENGINEER

If you want a recipe for that quite egotistical
Person that's known as the "great engineer"
Take lots of data that's seemingly mystical
Throw it at someone apparently queer;

A whole flock of integrals, sine curves and alpha-rays
Symbols which look like some primitive script;
Formulas giving the speed of beta-rays—
See that you have him completely equipped;

Sky-scraper, steam engine, turbine and factory,
Cram 'em all into the poor fellow's skull;
Tell him of forging and metals refractory—
Fill him with facts that are deadly and dull.

Expect him to know salts and hydrolysis, facts thermo-
dynamical and yet of petrography,
Show him the mysteries of metallography;
What if he balks and displays his precocity!
Tell him that light has an awful velocity!

Take of these elements all that are suitable,
Put each away in its own little niche;
Then you will have (this is quite irrefutable)
A man who could probably dig a good ditch!

—*The Mines Magazine.*

* * *

The Baltimore and Ohio Railroad Company,
Pittsburgh, Pennsylvania

Gentlemen: Why is it that your blasted switch engine has to ding and dong and fizz and sputt and spit and pant and grate and grind and puff and bump and bump and chug and hoot and toot and whistle and wheeze and howl and clang and growl and thump and crash and boom and jolt and screech and snarl and snort and slam and throb and roar and rattle and hiss and yell and smoke and smell and shriek like heck all night long when I come home from the boiler works and have to keep the dog and the baby quiet so my wife can squawk at me about how I snore?

Yours,
OSWALD SCHMERGELDRUGLE.

* * *

ADVICE TO FRESHMEN

In order to impress your girl and your friends that you are really an Engineer, determine to obtain a good slide rule. Get one, either buy it or find it, with as many scales and numbers as possible. Get a magnifying glass on the slide by all means. Your errors will be more accurate.

—*Iowa Engineer.*

A motorist was helping his extremely fat victim to rise. "Couldn't you have gone around me?" growled the victim

"Sorry," said the motorist sadly, "I wasn't sure that I had enough gasoline"

* * *

Someone throw an axe at you?
Nope, got a haircut.
Well, sit higher in the chair next time.

—*Kansas Engineer.*

* * *

The famous snow woman may have found her virile Engineer, but it took an Architect to make her.

* * *

With queenly grace she floated along the street, but at the curb she paused and her little pink brow furrowed as she gazed at the river of mud before her. Our hero, seeing her plight, rushed to her side and tearing off his topcoat, spread it in the mud so that she might not soil her lovely slippers. She gazed at him in wonder for a moment, then murmured softly, "Well, of all the damn fools!"

* * *

I had twelve bottles of whiskey in my cellar and my wife told me to empty the contents of each bottle down the sink, or else. So I said I would and proceeded with the unpleasant task.

I withdrew the cork from the first bottle and poured the contents down the sink, with the exception of one glass which I drank. I extracted the cork from the second bottle and did likewise with the exception of one glass which I drank.

I then withdrew the cork from the third bottle and emptied the good old booze down the sink, except a glass, which I drank. I pulled the cork from the fourth sink, and poured the bottle down the glass, which I drank.

I pulled the bottle from the cork of the next—and drank one sink out of it and poured the rest down the glass. I pulled the sink out of the next glass and poured the cork down the bottle. I pulled the next cork out of my throat and drank the glass. Then I corked the sink with the glass, bottled and drank and drank the pour.

When I had everything emptied, I steadied the house with one hand, counted the bottles and corks and glasses with the other, which were 29. To be sure I counted them again when they came by and I had 74. And as the house came by I counted them again and finally I had all the houses and bottles and corks and glasses counted, except one house and one bottle, which I drank.

G-E *Campus News*

ICE WATER

New electric drinking-water coolers introduced by General Electric have replaced the antiquated ice-cooled type on several prominent Midwestern railroads. This is another step in the modernization program being carried on by railroads to increase passenger traffic.

The new coolers are designed to overcome many disadvantages of the ice-cooled units. With foot operation of the self-contained units, only one hand need be used to get a drink. Cleanliness is promoted because of the absence of ice-filling operations, and the expense for maintenance and service is reduced to a minimum.

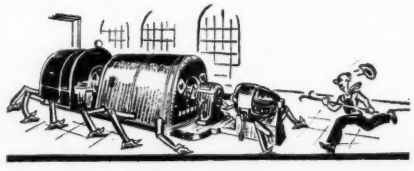
The water is automatically maintained at a healthful and refreshing temperature through thermostatic control. Coolers are designed either as self-contained units or as separate cooling and refrigerant condensing units for remote installations in the car.

AS VACUUM TUBES GREW UP

As the vacuum tubes grew, they found their style cramped because metal could be sealed to glass only in thin strips. Research took up the problem, and it is now possible to fabricate glass and metal together, in any size or shape, very much as two metals are fabricated.

In a successful glass-to-metal seal, the temperature coefficients of expansion of the glass and the metal must agree exactly over a wide range of temperature. Painstaking investigation—much of it in the General Electric Research Laboratory, at Schenectady—developed new alloys and new glasses, which could be used for this application.

The first application of this new knowledge has been in metal radio tubes, now standard in almost all radio receivers. Power thyratrons, switches, capacitor bushings—all these follow along the new trail. We cannot predict how far this new technique will go, but the possibilities are numerous and inviting.



TURBINE STEEL CREEPS

If the wrong kind of steels were used in turbine construction, the machine would not go creeping across the floor with the operator in hot pursuit, but the results might be even more disastrous.

Part of the increase in efficiency that has come about in the power-generating field in the last few years has been due to increased steam temperatures and pressures. As a result, the modern turbine shell runs, almost literally, red hot. This shell must withstand pressures such as exist half a mile down in the ocean and must keep a 20-ton rotor spinning perfectly in line. Heat softens metal, just as it softens candy, and permits it to stretch. This stretch, however, must be kept to the merest creep—about one part in 1000, if the changes are uniform.

In the Schenectady Works turbine shop, automatic electric furnaces hold samples of turbine steel at the temperature which will occur in the turbine. Gauges, which indicate changes of one part in a million, measure the creep as the pieces are exposed to heat for years at a time. From these tests, the best steel is selected.

It has been largely due to this research carried on by General Electric that the temperature and pressure of steam used in power generation have been raised to unexpected highs in the last few years.

96-363DH

GENERAL ELECTRIC